Signal Engineering, Inc.

PRODUCT SERVICE BULLETIN

FORM	QAF-155
REVISION	AA
DATE	8-MAY-14

PSB No.	**PSB-24000-0001 AA**	***ISSUE DATE***	03-23-2022

TITLE:	Firmware Update
COMPLIANCE:	☐ Mandatory, ☐ Information, ☒ Recommended Change, ☐ Recommended Inspection
APPLICABILITY:	This Product Service Bulletin (PSB) applies to all OmniSat-1 units using a GPS receiver to automatically get time-of-day from GPS.
ABSTRACT OF ISSUE:	New OmniSat-1 GOES firmware version 2.8 is released to correct a GPS timekeeping issue. 1.) When 19.6 years have passed since the creation date of the firmware in the GPS receiver, a GPS Week Number Roll-Over (WNRO) will occur, causing the UTC date output by the GPS receiver to be incorrect. This will occur on either March 19, 2023 or July 6, 2025, depending on the version of the GPS receiver used in the OmniSat-1.

SCOPE

This service bulletin applies only to the Signal Engineering Inc. “OmniSat” model (GOES Version 1.0B 300/1200 BPS DCPRS) transmitter (referred to in this document as the “OmniSat-1”) that includes a GPS receiver and automatically gets time-of-day from GPS. The OmniSat-1 was in production from 2004 until 2011.

Most (but not all) OmniSat-1 transmitters were equipped with a GPS receiver. The firmware update described here is NOT required for configurations where time-of-day is loaded into the OmniSat-1 by the datalogger. In those cases, there is no GPS antenna connected to the OmniSat-1.

The GPS WNRO issue described in this service bulletin does NOT apply to the earlier Signal Engineering “SE300” or “SE1200” model (GOES Version 1.0B 300/1200 BPS DCPRS) transmitters or to the later “OmniSat-3” model (GOES Version 2.0 300/1200 BPS DCPRS) transmitters.

OmniSat-1s were built with either a 14-pin or a 10-pin control interface connector. Most (but not all) OmniSat-1s with 14-pin connectors were deployed with Vaisala dataloggers. Most (but not all) OmniSat-1s with 10-pin connectors were deployed with Design Analysis dataloggers.

OmniSat-1s with a 14-pin control interface connector support both an RS-232 control interface and an HSB (Handar Serial Bus) interface. The firmware update procedure described in this service bulletin is intended for OmniSat-1s that are normally operated using their RS-232 control interface and requires that the RS-232 control interface be enabled. It updates the Main (RS-232) firmware image but does not update the HSB firmware image in the OmniSat-1.

See the end of this document for example views of OmniSat-1s with the different labels and connector configuration that were shipped to customers.

RECOMMENDATION & RISK

OmniSat-1 shipments began in March 2004. All OmniSat-1s that were shipped before May 2006 will have a WNRO on March 19, 2023. Most OmniSat-1s that were shipped in or after May 2006 had GPS receiver firmware that will have a WNRO on July 6, 2025. A small number of the OmniSat-1s shipped after May 2006 have older GPS receiver firmware and will have a WNRO on March 19, 2023.

For users who wish to continue operating their OmniSat-1s after March 19, 2023, Signal Engineering Inc. recommends updating the firmware in all OmniSat-1 units that have a GPS receiver and automatically get time-of-day from GPS. The GPS Week Number Roll-Over issue will cause any unit that has not been loaded with the new firmware to return the wrong UTC date after the WNRO event occurs.

This risk involved in the firmware reload is low. Since only the main runtime firmware image is updated, the bootloader firmware should not be affected. This means that in the event of a failure during the firmware reload, it should always be possible to use the bootloader firmware image to retry the firmware reload until successful.

BACKGROUND

ISSUE: GPS Week Number Roll-Over

The GPS system keeps time using the combination of a GPS Week Number and a GPS Time Of The Week. The GPS Week Number is a 10-bit number that counts up from 0 to 1023 and then rolls over back to 0. A GPS Week Number Roll-Over (WNRO) occurs in the GPS system every 19.6 years. The last GPS system WNRO occurred on April 7, 2019.

The vendor (u-blox) of the GPS receiver used in the OmniSat-1 made each version of receiver firmware such that it will provide the correct UTC date for 19.6 years, starting from the date the GPS receiver firmware version was created. After that, the GPS receiver will experience the equivalent of a GPS system WNRO and the UTC date provided by the GPS receiver will roll back to a date 19.6 years in the past and then move forward from there.

During its production run, the OmniSat-1 used versions of the u-blox GPS receiver that will experience this WNRO effect on one of two different dates: either March 19, 2023 or July 6, 2025. Following the WNRO, the date returned by the GPS receiver will roll back to a date 19.6 years in the past and then move forward from there. The UTC time it returns will be correct, but the date will be wrong.

Support from u-blox for the GPS receiver used in the OmniSat-1 ended over 10 years ago, so no new GPS receiver firmware is available to address this issue. Instead, the GPS vendor (u-blox) published an application note that details a workaround method that could be implemented in the “host” device (in this case, the OmniSat-1) that is connected to the GPS receiver and allows the erroneous dates output by the GPS receiver after the WNRO to be corrected.

SEI has developed a new version of OmniSat-1 firmware (V2.8) that implements the workaround method suggested by the GPS vendor. The new OmniSat-1 firmware detects and corrects any erroneous UTC date output by the GPS receiver after the WNRO and allows the OmniSat-1 to maintain correct UTC time in its time-of-day clock for up to 16 additional years.

For details on the workaround method used to handle the GPS WNRO, see the u-blox application note: “GPS week number roll-over workaround Application Note, UBX-19016936”. This document is available on the u-blox website at www.u-blox.com .

INSTRUCTIONS

The OmniSat-1 firmware can be upgraded at the user or distributor level. Signal Engineering has created a loader program for Windows PCs that reloads the OmniSat-1 with the new version of firmware. The new OmniSat-1 firmware is embedded within the loader program. The loader program verifies that the transmitter it is connected to is an OmniSat-1 before reloading the firmware. The loader program should work on any version of Microsoft Windows XP, Windows Vista, Windows 7, Windows 8, and Windows 10.

The new OmniSat-1 V2.8 firmware can be deployed at any time before or after the GPS WNRO event. If deployed before the WNRO it will have no effect on normal operation. It will detect and correct the erroneous UTC dates output by the GPS receiver after the WNRO occurs, providing seamless continuity of operation.

Perform the following steps to upgrade the OmniSat-1 firmware to the new version:

Step 1: PC Data Cable

If you don't already have one, make a data cable to connect a PC's RS-232 serial port to the OmniSat-1's control interface connector. See the "PC Data Cable For OmniSat-1 With 10-Pin Connector" and "PC Data Cable For OmniSat-1 With 14-Pin Connector" sections at the end of this document for details. Since the OmniSat-1 can have either a 14-pin or a 10-pin control interface connector, the type of cable needed will depend on the type of connector on the OmniSat-1. Most (but not all) OmniSat-1s with 14-pin connectors were deployed with Vaisala dataloggers. Most (but not all) OmniSat-1s with 10-pin connectors were deployed with Design Analysis dataloggers.

A PC Data Cable for an OmniSat-1 will typically consist of a 9-pin female D-sub connector (to connect to the PC's 9-pin serial port), a 10-pin or 14-pin 2-row ribbon cable connector (to connect to the OmniSat-1) and a length of AWG 26 or AWG 28 flat ribbon cable (0.5 meter to 1 meter in length) with the same number of conductors as the number of pins in the OmniSat-1 control interface connector.

If the PC to be used does not have either a built-in RS-232 serial port or a serial port on a PCI or PCIe plug-in card, a USB-to-RS232 serial port adapter will be needed. In addition to the normal RS-232 Signal Ground, Transmit Data and Receive Data signals, the adapter must also support the RS-232 RTS and CTS control signals.

Step 2: Copy Firmware Loader Files to PC

Copy the firmware loader files 'OmniSat1ProgrammerV28.exe' and 'OmniComLib.dll' to the same folder on the PC to be used. These files are available on request from Signal Engineering Inc.

Step 3: Connect Power Supply and Data Cable

If using a DC power supply, set the voltage to 12.5 volts. The power supply should be capable of providing a current of at least 100 mA. If using a battery, ensure that the supply voltage is between 10.5 and 15 volts.

Connect the power supply or battery to the OmniSat-1 and connect the PC serial port to the OmniSat-1 control interface connector using the data cable.

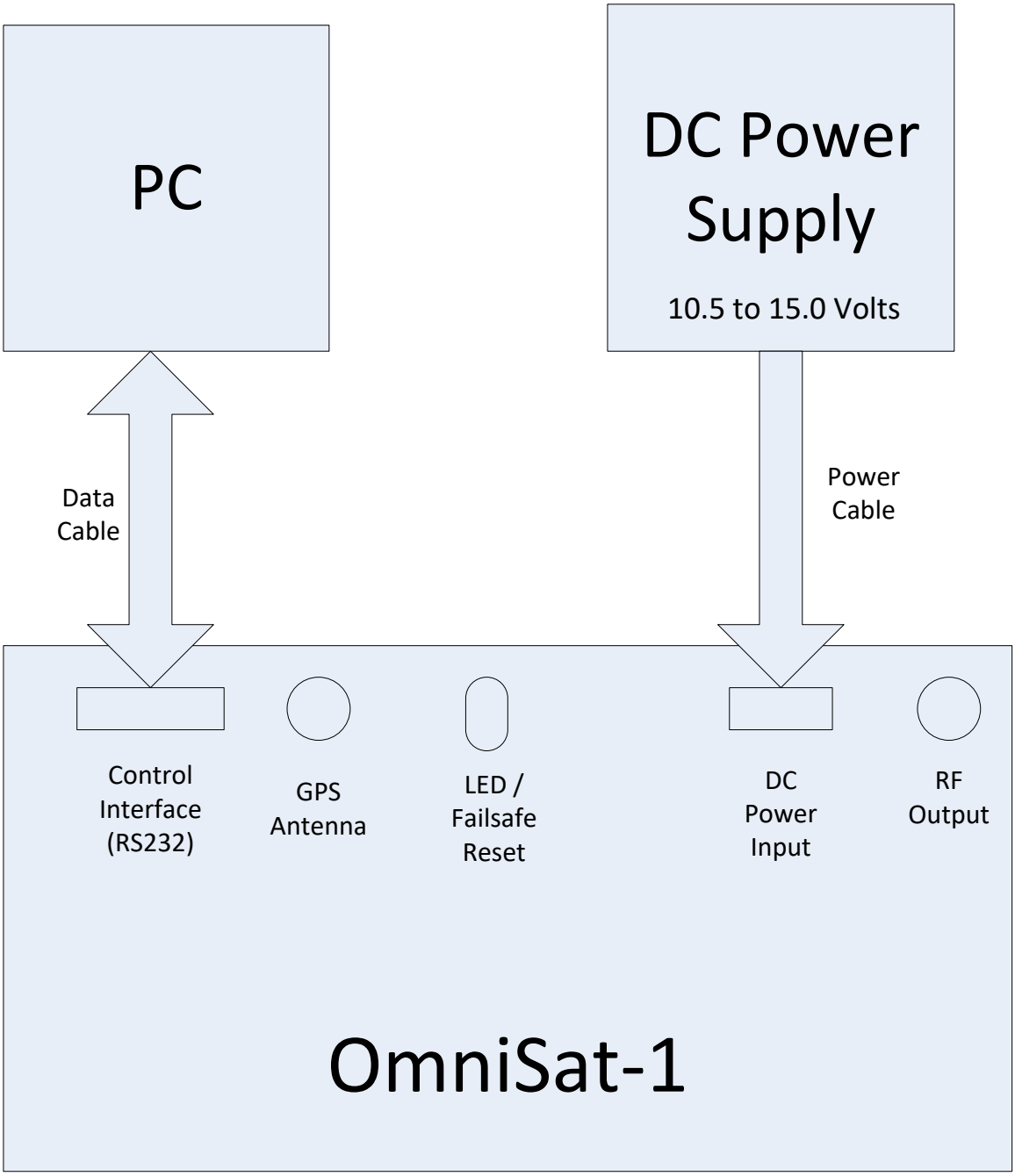

Figure 1 - OmniSat-1 programming setup

When power is applied to the OmniSat-1, the red LED next to the Failsafe Reset pushbutton switch will blink 2 times to indicate that the Main (RS-232) firmware image is running and the RS232 interface is enabled. If the LED blinks 6 times, this indicates that the Bootloader firmware image is running and the Main firmware is missing or corrupt and needs to be reloaded. Wait until the LED finishes blinking its pattern before continuing.

NOTE: If the LED blinks 4 times after power on, this indicates that the HSB firmware image is running and the HSB control interface is enabled (and the RS-232 interface DISABLED). The procedure described here does not apply to OmniSat-1s with their HSB interface enabled.

Step 4: Launch Firmware Loader Program

Launch the firmware loader program 'OmniSat1ProgrammerV28.exe'. This can be done by launching Windows Explorer, browsing to the folder containing the loader program, and then double-clicking on file 'OmniSat1ProgrammerV28.exe'.

Step 5: Check OmniSat-1 Firmware

On the firmware loader program screen, select the Microsoft Windows ComPort (COM1…COM99) for the PC serial port to be used. The Baud rate is fixed at 9600 Baud. Click on 'Check Firmware' to check communication with the OmniSat-1 and to see if the OmniSat-1 needs to be reloaded with the new V2.8 firmware. The firmware loader program will also verify that the transmitter is an OmniSat-1.

Step 6: Load New OmniSat-1 Firmware

Click on 'Load Firmware' to begin the firmware load. The reload of the Main (RS232) firmware image with the new V2.8 firmware takes about 2.5 minutes. Status is reported in the 'Firmware Load Status' window and progress messages are displayed in the 'Debug Output' window. The firmware loader program will retry commands sent to the OmniSat-1 multiple times if necessary. If the firmware load is unsuccessful for any reason, correct any power or connection issues and retry the firmware load until successful.

PC Data Cable For OmniSat-1 With 14-Pin Connector

The 14-pin control connector contains an interface through which control information, status information and data are passed to and from the OmniSat. Table 1 lists the signal assignments for each pin on the connector.

Table 1: OmniSat-1 14-Pin Control Connector Description

Pin #	Signal	Signal Type	Description
1		NC	No Connect
2	GND	Ground	Ground
3		NC	No Connect
4	GND	Ground	Ground
5		NC	No Connect
6	GND	Ground	Ground
7		RES	Reserved (Must be No Connect at host end)
8		RES	Reserved (Must be No Connect at host end)
9		RES	Reserved (Must be No Connect at host end)
10		RES	Reserved (Must be No Connect at host end)
11	232RTS	Input	Request To Send, RS232 compatible
12	232CTS	Output	Clear To Send, RS232 compatible
13	232RXD	Input	Receive Data, RS232 compatible
14	232TXD	Output	Transmit Data, RS232 compatible

OmniSat Bulkhead Connector:
3M 2514-6002 (Low profile 14-pin box header)

Mating Flat Cable Connector:
3M 3385-6600 (14-pin socket connector, open-ended for daisy-chaining)
or 3M 3385-7600 (14-pin socket connector, closed-ended for line termination)
3M 3448-3014 (Clip-on strain relief for 14-pin socket connector)

ADDITIONAL NOTES:

1. “Input” signals are from the external host to the OmniSat.
2. “Output” signals are from the OmniSat to the external host.

Table 2: PC Data Cable for OmniSat-1 With 14-Pin Connector

9-Pin PC Serial Port Pin #	PC Serial Port Signal	OmniSat Pin #	OmniSat Signal	OmniSat Signal Type	OmniSat Signal Description
5	Ground	2	GND	Ground	Signal Ground
7	RTS	11	232RTS	Input	Request To Send
8	CTS	12	232CTS	Output	Clear To Send
3	TXD	13	232RXD	Input	Receive Data Input
2	RXD	14	232TXD	Output	Transmit Data Output

PC Data Cable For OmniSat-1 With 10-Pin Connector

The 10-pin control connector contains an interface through which control information, status information and data are passed to and from the OmniSat. Table 3 lists the signal assignments for each pin on the connector. The signal names and connections between the external host and the OmniSat follow an RS232 null-modem connection convention. All OmniSat control interface signals are compatible with standard RS232 logic levels.

Table 3: OmniSat-1 10-Pin Control Connector Description

External Host Signal	OmniSat Connector Pin #	OmniSat Signal	OmniSat Signal Type	OmniSat Signal Description
DCD	1	DCD	NC	No Connect
DSR	2	DTR	NC	No Connect
RXD	3	TXD	Output	Transmit Data, RS232 compatible
RTS	4	CTS	Input	Clear To Send, RS232 compatible **
TXD	5	RXD	Input	Receive Data, RS232 compatible
CTS	6	RTS	Output	Request To Send, RS232 compatible
DTR	7	DSR	NC	No Connect
RI	8	RI	NC	No Connect
GND	9	GND	Ground	Ground
NC	10	GND	Ground	Ground

OmniSat Bulkhead Connector:
3M 2510-6002 (Low profile 10-pin box header)

Mating Flat Cable Connector:
3M 3473-6600 (10-pin socket connector)

ADDITIONAL NOTES:

1. “Input” signals are from the external host to the OmniSat.
2. “Output” signals are from the OmniSat to the external host.

Table 4: PC Data Cable for OmniSat-1 With 10-Pin Connector

9-Pin PC Serial Port Pin #	PC Serial Port Signal	OmniSat Pin #	OmniSat Signal	OmniSat Signal Type	OmniSat Signal Description
5	Ground	9	GND	Ground	Signal Ground
7	RTS	4	CTS	Input	Clear To Send
8	CTS	6	RTS	Output	Request To Send
3	TXD	5	RXD	Input	Receive Data Input
2	RXD	3	TXD	Output	Transmit Data Output

OmniSat-1 Front View with Signal Engineering, Inc. Label

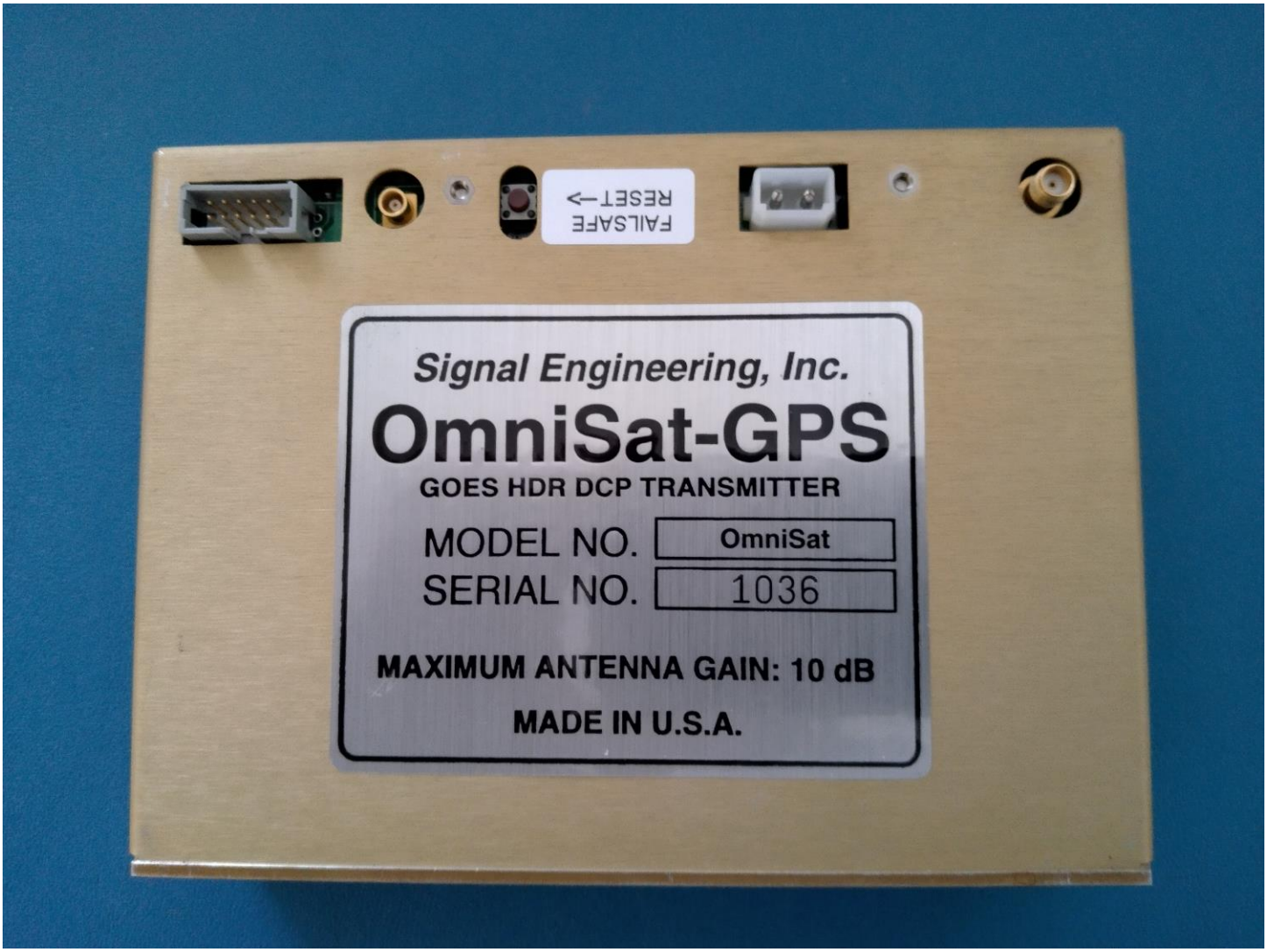

Figure 2 - OmniSat-1 with 10-pin Control Connector and SEI Label

OmniSat-1 Front View with Vaisala Configuration and Label

Figure 3 - OmniSat-1 with 14-pin Control Connector and Vaisala Label

OmniSat-1 Front View with Design Analysis Configuration and Labels

Figure 4 - OmniSat-1 with 10-pin Control Connector and Design Analysis Labelling